Living with a Star Targeted Research and Technology (TR&T) Steering Committee

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Scott McIntosh (NCAR / HAO)
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Liaison Members:
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Masha Kuznetsova (GSFC / Community Coordinated Modeling Center)
Mona Kessel (NASA HQ / Van Allen Probes)
Dean Pesnell (GSFC / Solar Dynamics Observatory)
David Sibeck (GSFC / Van Allen Probes)
Adam Szabo (GSFC / Solar Probe Plus)
Chris St. Cyr (GSFC / Solar Orbiter)

LWS Program Ex Officio:
Elsayed Talaat & Jeff Morrill (NASA HQ), Shing Fung (GSFC)

2003 Science Definition Team Report: Living with a Star Objectives

LWS initiative: goal-oriented research program targeting those aspects of the Sun-Earth system that directly affect life and society.

The objectives of LWS will advance research in Sun-Earth system science to new territory, producing knowledge and understanding that society can ultimately utilize.

2003 LWS Science Definition Team Report: TR&T Program

The Targeted Research and Technology (TR&T) component of LWS provides the theory, modeling, and data analysis necessary to enable an integrated, system-wide picture of Sun-Earth connection science with societal relevance.

Science Definition Team (SDT) … formed to design and coordinate a TR&T program having prioritized goals and objectives that focused on practical societal benefits.

TR&T Steering Committee

TR&T Steering Committee (TSC), with broad science and application community representation and with rotating membership, to advise and support NASA Headquarters in:

- Establishing and continually updating targets and top-level priorities

- Measuring the progress of the program in meeting science goals and objectives

- Providing mechanisms for monitoring how well products that result from the program are transferred into societal benefits.

TR&T Steering Committee Finding From February 8-9, 2016 Meeting:

"Procedure for Development of Annual TR&T Science Topics"

It is vital for the success of the Living with a Star Targeted Research and Technology (LWS TR&T) program that there be active community engagement in the development of annual TR&T science topics.

Procedure for Development of Annual TR&T Science Topics

The LWS TR&T Steering Committee (TSC) finds that the following procedure should be followed to solicit and obtain community input for and to then develop these science topics:

- Encourage active community input to TR&T science topics
- Draft science topics at second TSC meeting
- Solicit community comment on draft TR&T science topics
- Finalize science topics at third TSC meeting

Encourage active community input to TR&T science topics:

- Announce call for community input to science topics through Space Physics and Aeronomy newsletter, Solar News, and other newsletters and e-mail lists every 2 weeks for a 6 week input period.

- Produce a short summary and explanation of this call for presentation at conferences, in newsletters, and at individual institutions.

- Hold an online town hall where the call for topics is explained and community questions and input are solicited.

- Release the suggested science topics online as they are submitted, without submitter identifying information. Include a comment box for each topic to provide a place for comments and discussion. This page should be archived.

Draft science topics at second TSC meeting:

- At its second meeting, following the 6 week input period, the TSC develops draft science topics based on the community input received and based on the established LWS TR&T goals.

Note: LWS TR&T goals target the following Strategic Science Areas (SSA's):

- SSA-0: Solar electromagnetic, energetic particle, and plasma outputs driving the solar system environment and inputs to Earth's atmosphere
- SSA-1: Geomagnetic Variability
- SSA-2: Satellite Drag
- SSA-3: Solar Energetic Particles
- SSA-4: Total Electron Content (TEC)
- SSA-5: Ionospheric Scintillation
- SSA-6: Radiation Environment

Solicit community comment on draft TR&T science topics:

- Release (online) these draft science topics to the community for a comment period of at least 6 weeks.

- During this comment period, present these draft science topics at / via:
  - ➢ conferences
  - ➢ online town halls
  - ➢ Newsletters and e-mail lists

Finalize science topics at third TSC meeting:

- At its third meeting, following this comment period, the TSC finalizes the TR&T science topics and compiles the TSC annual report, incorporating community feedback on the previously released draft science topics.

Findings for Future year TSCs:

- Seek science topic input via:
  - ➢ Final write-up of LWS institutes.
  - ➢ Town hall and science discussion sessions at conferences.
  - ➢ Final write-up of LWS science teams.

Supporting Material: SSA's

LWS Strategic Science Areas: Development of Predictability and Interactions with User Communities

2013 TR&T Steering Committee Report:

"Over the past ten years, the LWS program has built a remarkable foundation of strategic capabilities and focused science topics (FSTs). We are now in the position to leverage these for the development of predictive capabilities in key areas of LWS science."

"As such, rather than concentrating on devising FSTs on separate areas of Heliophysics, the LWS SC has formulated long-term targeted areas of System Science, requiring cross-disciplinary collaboration, for predictive development, termed Strategic Science Areas (SSA)"

Strategic Science Areas:

SSA-0: Solar electromagnetic, energetic particle, and plasma outputs driving the solar system environment and inputs to Earth's atmosphere

SSA-1: Geomagnetic Variability

SSA-2: Satellite Drag

SSA-3: Solar Energetic Particles

SSA-4: Total Electron Content (TEC)

SSA-5: Ionospheric Scintillation

SSA-6: Radiation Environment

SSA-0

SSA-0: Solar electromagnetic, energetic particle, and plasma outputs driving the solar system environment and inputs to Earth's atmosphere

Develop physics based understanding enabling forecast capabilities of the variability of solar magnetism, with a particular focus on better understanding of the processes that drive the formation, interaction, and emergence of magnetic flux systems in the solar interior on time scales from days to decades.

Advance understanding of the impacts of such flux systems for the space environment and the responses of Earth's atmosphere.

SSA-1

SSA-1: Geomagnetic Variability

The goal is to develop the physics-based understanding to enable 1 – 3 day (long lead-time) and 15 – 30 minute (short lead-time) forecasting, including predictability of pending severe geomagnetic disturbances.

SSA-2

SSA-2: Satellite Drag

The goal is to develop scientific capabilities that enable specification of the global neutral density in the thermosphere and its variations over time.

This development will lead to the ability to predict the densities that satellites in low-Earth orbit will encounter with a lead-time of at least one hour as well as longer-term predictions out to at least three days and preferably to seven days or longer.

There should be quantifiable levels of uncertainty that are specified for different data conditions and levels of redundancy in data/models

SSA-3

SSA-3: Solar Energetic Particles

The goal is develop scientific understanding that enable probabilistic prediction of the spectral intensity of SEP events, and increased time periods for all-clear forecasts with higher confidence level.

SSA-4

SSA-4: Total Electron Content (TEC)

The goal is to derive a model, or coupled set of models, that enable specification of the global ion density in the topside ionosphere and plasmasphere and its variations over time under varying geomagnetic conditions.

The model or coupled models should develop the capability to predict the TEC observations globally, with a lead time of at least one hour (based on availability of real-time solar wind/IMF measurements), as well as longer-term predictions for up to three days based on solar wind forecasts.

SSA-5

SSA-5: Ionospheric Scintillation

The goal is to develop the scientific understanding necessary to predict scintillation occurrence utilizing limited sources of available data and ascertain how radio signals are degraded by ionospheric irregularities.

Achieving this will require elucidation of the complete set of physical mechanisms responsible for producing ionospheric irregularities, the most important sources of free energy, and the causal chains that both generate and suppress irregularities leading to scintillations.

SSA-6

SSA-6: Radiation Environment

The goal is to develop a physics-based understanding of the atmospheric radiation environment from galactic cosmic rays (GCR) and solar energetic particle (SEP) sources, and the variabilities associated with cutoff rigidity, atmosphere density, and gamma-ray/X-ray inputs.

Other success measures will include the development and application of new observational methods, both in situ and remote, that lead to new data sets for assimilation into models on global and regional scales, and new insights into the spatial/temporal scales of radiation storm variations that are affected by space weather.